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Description of a New Species of *Emersonella* (Hymenoptera: Eulophidae) from Brazil, with Preliminary Observations on its Biology

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Abstract.—***Emersonella trimaculata* Azevedo and Silva, new species,** an egg parasitoid of chrysomelids, from northeastern Brazil is described and illustrated. Host age influences percent parasitism, which decreases as age increases, but it does not influence the sex ratio. The egg phase has an average duration of 1.05 ± 0.04 days, larval phase of 5.04 ± 0.19 days, pupal phase of 6.74 ± 1.16 days. The total time of development is 13.29 ± 0.53 days for males and 13.96 ± 0.48 days for females.

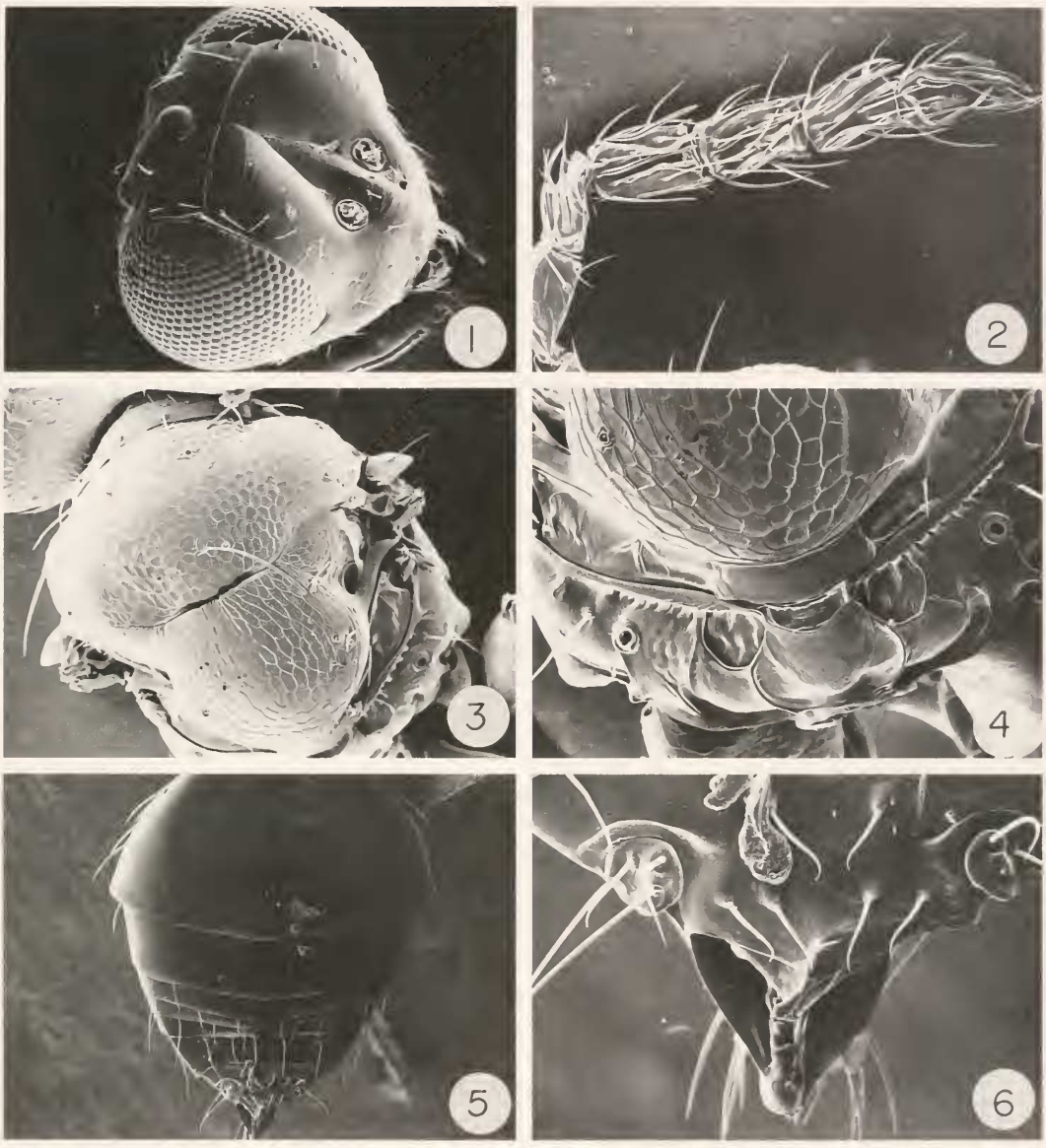
Emersonella Girault is a small genus of Entedoninae (Hymenoptera, Eulophidae) restricted to the New World (Boucek 1977). All species with known biology are idiobiont endoparasitoids of eggs of Chrysomelidae (Cox 1994), mainly Cassidinae. De Santis (1983) revised the genus and described four species from Brazil, Argentina and Uruguay. In this paper, a new species of *Emersonella* from the State of Maranhão in northeastern Brazil, is described and illustrated. Some preliminary biological studies are also included. Influence of the host age on the capacity of parasitism and sex ratio of the parasitoid is verified, the egg morphology is characterized, and the longevity of the egg, larval and pupal phases are determined.

MATERIAL AND METHODS

Morphological terminology for the description generally follows Gibson (1997) and sculpture follows Harris (1979). The material examined was provided by the Entomological Collection of Universidade Federal do Espírito Santo (UFES) and Universidade Federal de Viçosa (UFVB).

For the biological studies, mated and nulliparous females were maintained separately in flasks of 50ml containing a drop of a 1:1 solution of honey and water stuck to the wall of the glass as food, covered with cotton and kept at 28 ± 1°C. The parasitoid and its host *Zatrephina meticulosa* (Spaeth) (Coleoptera, Chrysomelidae) was obtained from field collections from São Luiz, State of Maranhão, northeastern Brazil. This beetle occurs naturally on the leaves of *Ipomoea pes-caprae* L. (Convolvulaceae) in coast sand plain.

Two experiments were carried out. Experiment 1 was to verify the influence of the host age on the percent parasitism and sex ratio of the parasitoid. In this experiment, 80 egg masses of *Z. meticulosa* of different ages, varying from 1 to 8 days, were offered to females, separately in a flask. The females were kept with the host egg masses for 10 days before being removed from the flasks. Experiment 2 was to verify the duration of the egg, larval and pupal phases, and morphological characteristics of the egg. Host egg masses at 48



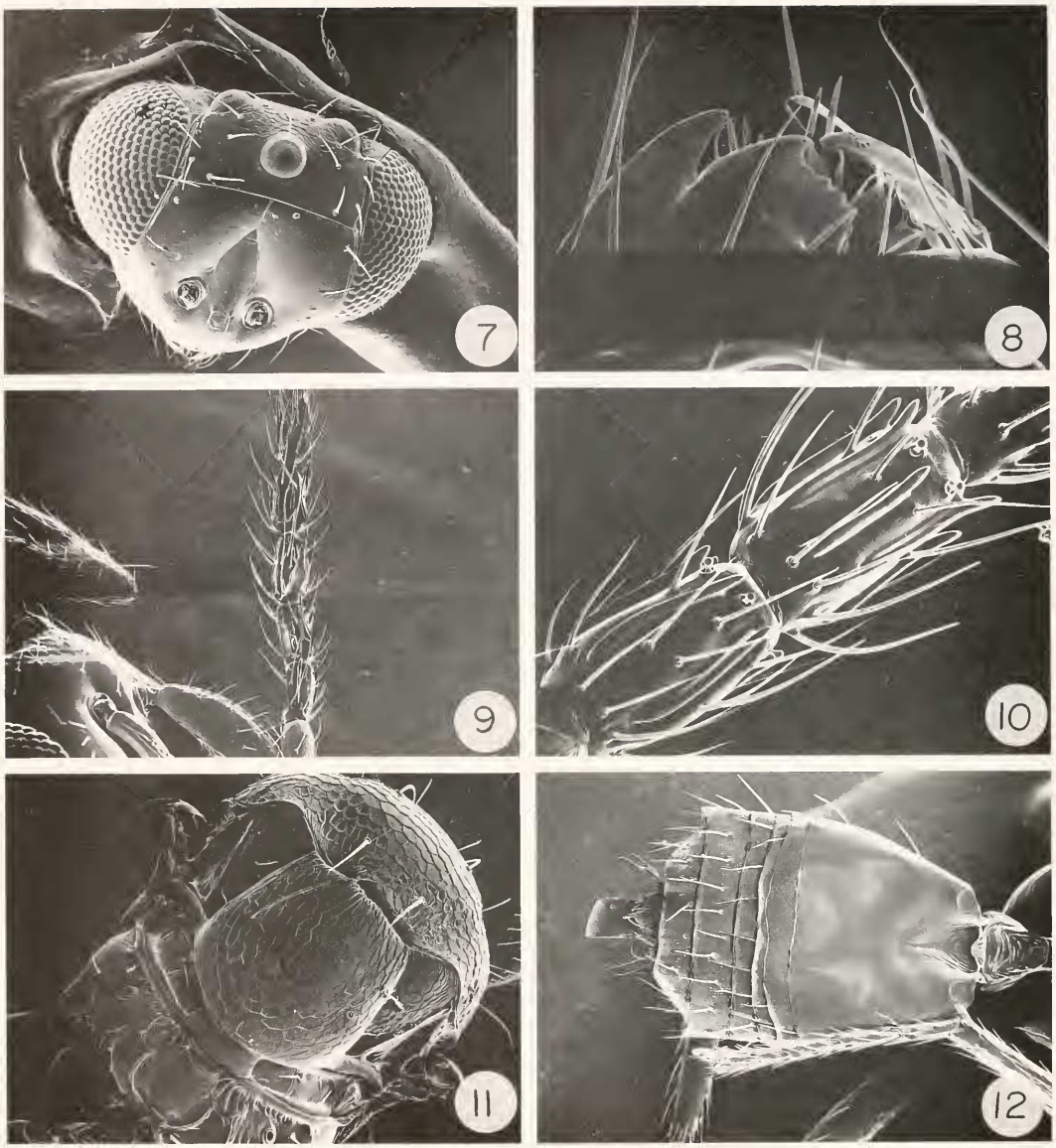
Figures 1–6. *Emersonella trimaculata*, female, dorsal view. 1, head; 2, antenna; 3, thorax; 4, propodeal disc, 5, metasoma; 6, ovipositor sheathes.

hours old were offered to groups of 30 to 40 nulliparous, recently mated females for 3 hours. To verify the phase of parasitoid development, samples of 15 host eggs were dissected in physiologic solution, at intervals of 24 hours. To verify the parasitoid egg phase, 10 host eggs were observed at one hour intervals. Observations were made from the 15th until the 29th hour to determine the type, morphology and size of the egg.

Emersonella trimaculata Azevedo and Silva, new species

(Figs. 1–12)

Female.—Length 0.85–1.01mm. Head and body black, except: head, scutellum and propodeum with yellowish green me-



Figures 7–12. *Emersonella trimaculata*, male, 7, head, dorsal view; 8, mandibles, lateral view; 9, antenna, lateral view; 10, antenna sensillae, lateral view; mesosoma, dorsal view; 12, metasoma, dorsal view.

tallic reflections; pronotum and scutum with blue metallic reflections; mandible testaceous-brown; scape yellowish white, pedicel brown, flagellomeres black; legs slightly yellowish, distal tarsomeres and anterior face of fore femur darker, coxae black with weak blue metallic reflection; bristles on body pale yellow; wings hyaline and veins light brown. **Head** (Fig. 1): 1.22–1.42 X as wide as long, 1.06–1.18 X wider than thorax in dorsal view. Frons and gena smooth, face nearly so, vertex imbricate. Distance between lateral ocellus 2.25–3.0 X as long as distance from lateral ocelli to eye. Transverse fronto-facial suture complete and conspicuous. Scrobal depression as long as scape. Malar space about 0.43–0.53 X the height of eye. To-

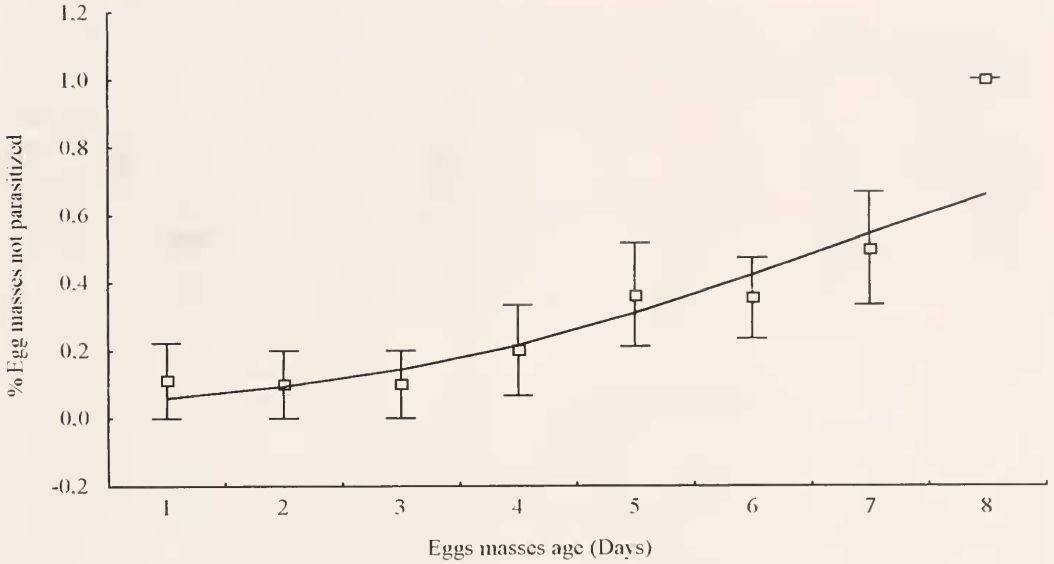


Figure 13. Percentage of egg mass posture not parasited by *Emersonella trimaculata*, in different ages of the host eggs. The bars represent the standard deviation.

rulus slightly closer to eye margin than clypeus. Vertex with ocular-ocellar suture. Eye with short hairs. Mandible bidentate, the lower larger, and the upper with upper margin serrated (Fig. 8). Antenna (Fig. 2): scape 3.75–4.3 X longer than wide; pedicel almost twice as long as wide; three anelli, the first slightly larger, the others subequal, funicular segments subquadrate, slightly longer than wide, club unisegmented, apex extended into terminal spine, 2–3 X longer than wide and 1.33–1.5 X longer than funicular segments. Sensillae capitate and elongate with apex slightly directed upward (Fig. 10). **Mesosoma** (Figs. 3–4): subquadrate in dorsal view, 1.16–1.25 X longer than wide, arched in lateral view. Pronotum not visible in full dorsal view, with a row of six setae along the posterior margin. Mesoscutum foveolate, with two rows of two adnotaular setae on each side, notaulus very weak, missing medially. Scutellum imbricate, enlarged, 0.75–0.89 X longer than mesosoma, 0.55–058 X as wide as mesosoma, about as long as wide, lateral sides distinctly convex. Dorsellum smooth. Propodeum smooth, with a pair of subtriangular depressions touching the anterior margin, with weak longitudinal striae medially, separated from each other by 1.2–1.5 X their width, without median carina and plica, with a sublateral carinae strongly arched, spiracle rounded, separated from the anterior margin of propodeum by about 1.0 X their diameter. Callus with two setae. Mesopleuron with a small anterior central pit. Forewing with marginal vein 2.3–2.4 X longer than submarginal vein. Postmarginal vein about as long as stigmal vein. **Metasoma** (Fig. 5): stout, subsessile, with few setae, 1.03 X as long as mesosoma; first gastral tergite large, about 0.5 X length of gaster, lateral margin evenly convex in dorsal view. Ovipositor sheath short (Fig. 6), anterior half concealed, ovipositor stylus 0.87 X as long as gaster.

Male.—Length 0.9–1.06 mm. Same color as female, except by: fore femur, fore tarsus and the other distal tarsomeres darker; gaster with three yellowish white spots, a pair of spots at anterior corner of first gastral segment, straight anteriorly and

rounded behind, separated from each other by 2.2–2.5 X their diameter, the third spot very large, occupying nearly the entire width of the posterior half of the first gastral tergite. **Head** (Fig. 7): Distance between lateral ocelli about 4–6 X as long as distance from lateral ocellus to eye. Antenna (Fig. 9): funicular segments slender, in ratio of about 2:2:2.6:2.3 X as long as wide; club 3–4 X as long as wide. **Mesosoma** (Fig. 11): 1.29–1.66 X longer than wide, scutellum 0.6–0.66 X wider than mesosoma. Forewing with marginal vein 2.1–2.4 X longer than submarginal vein. **Metasoma** (Fig. 12): petiolate, petiole larger behind, first gastral tergite 1.4–2 X longer than the rest of gaster, with anterior margin straight medially and angulate at corner laterally. Genitalia: paramere developed inward ventrally, with an apical setae directed outward; digitus wide, with two conspicuous spines directed outward apically, and with a small outer tooth; aedeagus with two lobes rounded apically; phallobase little developed in ventral side; aedeagus apodeme extending beyond the basal margin of phallobase only slightly.

Material examined.—♀ holotype, 11 ♀♀ and 15 ♂♂ paratypes BRAZIL, Maranhão, São Luiz, coast sand plain vegetation, 26.i.1998, J. C. Silva Jr. col. (UFES); 298 ♀♀ and 298 ♂♂ BRAZIL, reared in laboratory (AMNH, BMNH, CASC, CNCI, CUIC, DCBU, DZUP, EMUS, FSCA, IGBE, INPA, LACM, MCZH, MEPG, MZSP, OSUC, PMAE, UCDC, UCRC, UFES, UFVB, USNM).

Remarks.—This species runs to *Emersonella niveipes* Girault in the key presented by De Santis (1983), but here the mandible is bidentate and the male has three white spots in the gaster, while *E. niveipes* has the mandible with six teeth and the male has two transverse stripes just beyond the middle of the gaster. *E. ooecia* De Santis and *E. lecitophaga* De Santis are two species with a sub-basal white spot in the gaster of males as in *E. trimaculata*, but here there are two additional small spots in front of the large one, and the femora and tibiae are yellowish white rather than black as in the two former species. This species is also similar to *E. rotunda* (Ashmead), but in the last species the mid and hindcoxae are white and funicular segments are slightly longer. *Emersonella trimaculata* displays the same pattern of sexual dimorphism as other species in the genus. The male has funicular segments longer than those of the female and the gaster has three light spots on the first gastral tergite, while in the female the gaster is evenly black.

Biology.—A total of 80 egg masses were analyzed, with 57 parasitized (71.3%) and 23 (28.7%) not parasitized. The results indicate that host age influences parasitism by *E. trimaculata*. Parasitism decreased when older egg masses were offered to the females (logistic regression $\chi^2 = 12.7$; g.l. = 1 and $p < 0.01$; Fig. 13). The variation observed in parasitism was from only 11% not parasitized in the one-day-old egg masses up to 100% not parasitized in the eight-day-old egg masses.

According to the logistic regression, the expected value for eight-day-old egg masses was approximately 65% not parasitized, although the value was 100%. Only three egg masses were observed in the samples on the 8th day, while for the other days the number of egg masses was never smaller than nine. This difference might explain the deviation in relation to the model.

This same pattern was observed when the number of individual eggs parasitized was verified in each egg mass. Parasitism varied on the average from 81%, for one-day-old egg masses, up to 12%, for eight-day-old egg masses. Thus, as age of host increases, a reduction in parasitism occurs in both the number of egg masses and the number of eggs parasitized with each mass.

Host age does not influence sex ratio. The difference in sex ratio produced by females of *E. trimaculata* in egg masses of

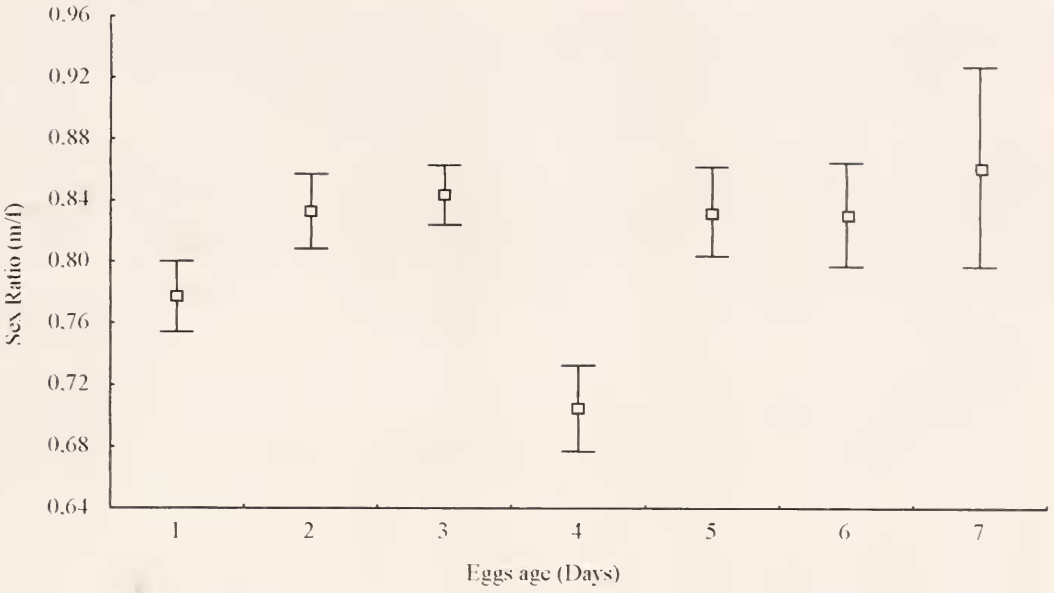


Figure 14. Relationship between the age of the egg and the sex ratio of *Emersonella trimaculata*. The bars represent the standard deviation.

different ages is not significant (χ^2 = 0.2; g.l. = 1 and p = 0.7; Fig. 14).

E. trimaculata eggs are 25.6 ± 1.4 μm in length with a maximum width of 6.8 ± 1.0 μm (Fig. 15). The eggs are simple, hymenopteriform, oblong or ovoid, slightly arched and with both poles smoothly round, with chorion delicate and without ornamentation as usually found in Hymenoptera (Clausen 1940). The egg phase had an average duration of 1.04 ± 0.04 days. The micropyle of the eggs was not observed, probably due to the transparency of the eggs (Fig. 15). However, there is a differentiated area in the anterior area, which might indicate the presence of the micropyle, which is usually located in the anterior region of the egg. In some species, however, it has been observed in the posterior area (Quicke 1997).

The larval phase has a duration of 5.0 ± 0.2 days, while the pupal phase lasts 6.7 ± 1.2 days. The pigmentation process begins in the first day of the pupal phase. Males of this species emerge before the females (χ^2 = 99.13; p <0.01), with almost all males emerging by the end of the sixth day of the pupal stage (91.56%), but only

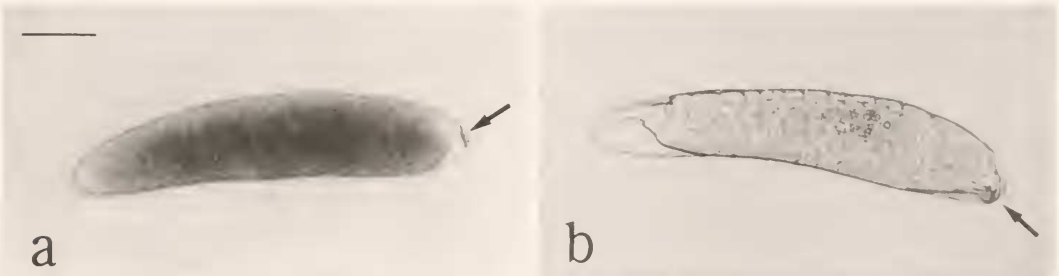


Figure 15. Eggs of *Emersonella trimaculata*; a, 2 hours of development; b, 20 hours of development. (Scale bar = 5 μm).

65.47% of the females. The total time of development was 13.3 ± 0.5 for males and 14.0 ± 0.5 for females.

In *E. trimaculata*, a small variation is seen in the duration of the egg and larval phases and a larger variation in the pupal phase. This can indicate the existence of mechanisms that synchronize the phases in this species. The results seem to indicate an abbreviation of the pupal phase of the males without loss of absorption of nutrients, since size differences do not exist between males and females.

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